J Nucl Med. 2014; 55 (Supplement 1):85

Neurosciences

Neurobiology of Psychiatric Disorders

Differential association between cerebral type 1 cannabinoid receptor (CB_1R) availability and body mass index in patients with food intake disorders and healthy controls

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Objectives: The type 1 cannabinoid receptor (CB_1R) is highly expressed in homeostatic and reward areas, which have key roles in regulating energy balance and feeding behaviour, and hence in weight gain and obesity. We investigated whether regional CB_1R availability and body mass index (BMI) are differentially associated in subjects with disorders of food intake (DFI; anorexia nervosa [AN], bulimia nervosa [BN], functional dyspepsia with severe weight loss [FD], and obesity [OB]) from healthy controls (CON).

Methods: A total of 80 subjects with a large BMI range were scanned using [^{18}F]MK-9470. Fifty-four subjects were DFI patients (14 AN, 16 BN, 12 FD, 12 OB; BMI range = 12.5-40.6 kg/m^2) and 26 CON matched for gender, age, and average BMI (BMI range = 18.5-26.6 kg/m^2). Correlations were assessed with key homeostatic (hypothalamus, pons, medulla, midbrain) and reward (nucleus accumbens, caudate nucleus, putamen, pallidum, orbitofrontal cortex, insula, amygdala) regions of interest ($P<0.05$ Stepdown-Bonferroni correction) and voxel-based analyses (SPM8, $P_{FWE\text{-}corrected}<0.05$).

Results: In CON, CB_1R availability was negatively correlated to BMI mainly in the homeostatic regions (all $P\leq0.05$ and $r>-0.60$). Conversely, in DFI subjects, the negative correlation between CB_1R availability and BMI was significant in both homeostatic (all $P<2.1e^{-04}$ and $r\geq-0.54$) and reward-related regions (all $P<2.8e^{-04}$ and $r\geq-0.51$).

Conclusions: Both the control and DFI groups showed a correlation with higher BMI having decreased CB_1R availability in homeostatic regions, playing a role in the control of energy homeostasis. However, in DFI subjects, the negative correlation was also present in the mesolimbic reward circuitry, which could result in inappropriate food intake and attribution of incentive value to food and hence result in either under- or overweight.

Research Support: Merck & Co, Inc. is acknowledged for availability of the [^{18}F]MK-9470 precursor. JT and KVL are Senior Clinical Investigators of the Flemish Fund of Scientific Research.